

Method of Test for  
**MECHANICAL ANALYSIS OF EXTRACTED AGGREGATE**  
DOTD Designation: TR 309M/309-94

**I. Scope**

- A. This method of test is intended to determine the gradation of aggregate extracted from asphaltic mixtures.
- B. Reference Documents:
  - 1. DOTD TR 113 - Sieve Analysis of Fine and Coarse Aggregates.
  - 2. DOTD TR 307 - Bitumen Content of Paving Mixtures by Reflux Extractor.
  - 3. DOTD TR 308 - Bitumen Content of Paving Mixtures by Centrifuge.
  - 4. AASHTO M 92 - Wire-Cloth Sieves for Testing Purposes.

**II. Apparatus**

- A. Balance - minimum 2000 g capacity, readable to 0.1 g.
- B. Sieves - woven wire with square openings, selected to furnish the information required by the specifications covering the material to be tested. They shall conform to AASHTO M 92.
- C. Sieve cover and collector pan
- D. Mechanical sieve shaker
- E. Drying devices
  - 1. Oven - capable of maintaining a uniform temperature of  $110 \pm 5^{\circ}\text{C}$  ( $230 \pm 9^{\circ}\text{F}$ ); or
  - 2. Hot plate - the use of electric or open flame hot plate drying is allowed where ovens are not available or practical. Open flame hot plates shall be equipped with a suitable shield to evenly disperse the heat and to avoid direct contact of the flame with the drying pan.
- F. Pans - sufficient to hold sample without spilling, and large enough to spread the material for rapid drying.
- G. Brush - to clean sieves.
- H. Stirrer - spoon or spatula.
- I. Thermal gloves, apron, container holder, eye protection - for use when handling hot material and equipment.

- J. Forms - Asphaltic Concrete Plant Report (Figure 1), Aggregate Test Report or other appropriate forms.
- K. Organic wetting agent - Calgon, Joy or other liquid dishwashing detergent.

**III. Health Precautions**

Proper precautions are to be taken whenever hot materials or equipment must be handled. Use container holder or thermal gloves while handling hot containers. Wear eye protection while stirring and weighing the heated materials due to possible shattering of particles. Dry materials under a vent to prevent exposure to potential fumes.

**IV. Sample**

The test sample shall consist of all the dry aggregate from the extracted sample of asphaltic mixture in accordance with DOTD TR 307 or DOTD TR 308. The initial dry total weight (w) of test sample from DOTD TR 307 or DOTD TR 308 is shown on the Asphaltic Concrete Plant Report.

**V. Procedure**

- A. Place test sample in a drying pan and add sufficient water to cover entire sample. To facilitate wetting the sample, add a small quantity of organic wetting agent to the water.
- B. Agitate contents of the drying pan vigorously and immediately pour washwater over a nest of two sieves consisting of a No. 10 sieve superimposed on a No. 200 sieve. The agitation shall be sufficiently vigorous to cause the complete separation of the coarse particles from all particles finer than the No. 200 sieve, and bring the fine particles into suspension so that they may be removed by decantation with the washwater.
- C. If the washwater is not clear, add more water to cover entire sample, and repeat step B. Otherwise, proceed

- with step D.
- D. Empty and wash all plus No. 10 and plus No. 200 material into the drying pan. Pour off the excess water.

**NOTE 1:** Do not lose any plus No. 200 material.

- E. Dry material to a constant weight (nearest 0.1 g) using oven or hot plate. Allow the sample to cool to comfortable handling temperature and weigh. Record this weight as the dry weight after wash (x) on the Asphaltic Concrete Plant Report.

**NOTE 2:** Constant weight for drying purposes is defined as less than 0.1% weight loss between successive weighings no less than 5 minutes apart.

- F. Sieve aggregate in accordance with DOTD TR 113 over sieves of the various sizes required by the specifications covering the mixture, including the No. 200 sieve. The minimum sieving time shall be 5 minutes when using a 45 degree mechanical shaker. The sieving time may have to be extended when using another type of mechanical sieve shaker.

**NOTE 3:** It is not the intent of this procedure to require that thoroughness of sieving be checked for each sample. However, a periodic check of sieving thoroughness should be made and documented.

- G. Determine and record the weight of material retained on each sieve. Also, determine and record the weight of material passing the No. 200 sieve.
- H. Subtract the dry weight after wash (X) from the initial dry total weight (W) which was previously recorded on the Asphaltic Concrete Plant Report. Record this difference as the decantation loss (Y).

- I. Add the weights determined in step G above to the decantation loss (Y) and record as the accumulated total (Z). The accumulated total (Z) is not to deviate from the initial dry total weight (W) by more than 0.2 percent. For deviations greater than 0.2 percent, the test is invalid.

## VI. Calculations

**NOTE 4:** Examples of the calculations are shown on the Asphaltic Concrete Plant Report.

- A. Calculate the percent deviation of the accumulated total from the initial dry total weight (% difference) to the nearest 0.01% in accordance with the following formula:

$$\% \text{ Difference} = \frac{W - Z}{W} \times 100$$

where:

W = initial dry tot. wt. of test sample from DOTD TR 307 or DOTD TR 308.

Z = accumulated total.

- B. Calculate the percentage of material retained on each individual sieve (PR<sub>x</sub>) to the nearest 0.01% in accordance with the following formula:

$$PR_x = \frac{WR_x}{Z} \times 100$$

where:

WR<sub>x</sub> = weight of oven-dry aggregate passing one size sieve and retained on the next smaller size sieve.

Z = accumulated total.

- C. Calculate the percentage of material coarser than each sieve (PC<sub>x</sub>) to the nearest 0.01% in accordance with the following formula:

$$PC_x = PR_1 + PR_2 + \dots + PR_x$$

where:

$PR_1, PR_2,$   
 $\dots, PR_x$  = percent of the test  
sample retained on a  
particular sieve.

- D. Calculate the percentage of material passing each sieve ( $PP_x$ ) to the nearest whole percent, except for the No. 200 sieve which is to the nearest 0.1%, in accordance with the following formula:

$$PP_x = 100 - PC_x$$

where:

$PC_x$  = percentage of test  
sample coarser than  
a particular sieve.

## VII. Report

- A. Report the percent passing each sieve (except No. 200) to the nearest whole percent.
- B. Report the percent passing the No. 200 sieve to the nearest 0.1%.
- C. Report the results of sieve analysis on the Asphaltic Concrete Plant Report or other appropriate form.

## VIII. Normal Test Reporting Time

Normal test reporting time is 8 hours.

**NOTE 5:** *Test reporting time may be reduced to two hours when using a hot plate for drying.*

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## Asphaltic Concrete Plant Report

### Figure 1